JOURNAL OF THE MECHANICS AND PHYSICS OF SOLIDS

EDITORS

L. B. FREUND
Brown University
Division of Engineering

J. R. WILLIS
Bath University
School of Mathematical Sciences

Volume 40 (1992)

Title Section, Volume Contents and Author Index

PERGAMON PRESS
OXFORD · NEW YORK · SEOUL · TOKYO

JOURNAL OF THE MECHANICS AND PHYSICS OF SOLIDS

Editors

L. B. FREUND

Division of Engineering, Brown University,
Providence, RI 02912, U.S.A.

J. R. WILLIS

School of Mathematical Sciences, University of Bath,
Claverton Down, Bath BA2 7AY, U.K.

Editorial Advisers

R. HILL (Editor-in-Chief 1952-68)—Cambridge
R. J. CLIFTON—Providence J. W. HUTCHINSON—Cambridge (MA)
K. L. JOHNSON—Cambridge J. R. RICE—Cambridge (MA)

Production Editor

V. McNEILL

*Publishing office: Headington Hill Hall, Oxford OX*3 0*BW, U.K.* (*Oxford* 794141)

Annual Subscription Rates 1993 *(including postage and insurance)*
Annual institutional subscription rate (1993) £770.00 (*US*$1463.00). *Sterling price is definitive. US dollar price is quoted for convenience only, and is subject to exchange rate fluctuation.*
Personal subscription rate for those whose library subscribes at the regular rate is available on request.
Subscription rates for Japan include despatch by air and prices are available on request.
Prices are subject to change without notice.
Published 8 *issues per annum in January, February, April, May, July, August, October and November. One volume per annum.*
Subscription enquiries from customers in North America should be sent to: Pergamon Press Inc., 660 *White Plains Road, Tarrytown, NY* 10591-5153, *U.S.A., and for the remainder of the world to: Pergamon Press Ltd, Headington Hill Hall, Oxford OX*3 0*BW, U.K.*

Whilst every effort is made by the publishers and editorial board to see that no inaccurate or misleading data, opinion or statement appears in this joumal, they wish to make it clear that the data and opinions appearing in the articles and advertisements herein are the sole responsibility of the contributor or advertiser concerned. Accordingly, the publishers, the editorial board and editors and their respective employees, officers and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement.

Second class postage paid at RAHWAY NJ. Postmaster send address corrections to Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.

Copyright © 1992 Pergamon Press Ltd

CONTENTS OF VOLUME 40

Number 1

Z. Suo, G. Bao and B. Fan	1	Delamination *R*-curve phenomena due to damage
J. R. Barber and F. A. Sturla	17	Application of the reciprocal theorem to some problems for the elastic half-space
L. N. McCartney	27	Theory of stress transfer in a 0°–90°–0° cross-ply laminate containing a parallel array of transverse cracks
R. Christensen, H. Schantz and J. Shapiro	69	On the range of validity of the Mori–Tanaka method
H. C. Choi and K.-S. Kim	75	Analysis of the spontaneous interfacial decohesion of a thin surface film
A. A. Rubinstein and K. Xu	105	Micromechanical model of crack growth in fiber-reinforced ceramics
K.-H. Kim	127	Evolution of anisotropy during twisting of cold drawn tubes
V. Gupta, A. S. Argon, D. M. Parks and J. A. Cornie	141	Measurement of interface strength by a laser spallation technique
Y. M. Leroy and A. Molinari	181	Stability of steady states in shear zones
S. Govindjee and J. Simo	213	Transition from micro-mechanics to computationally efficient phenomenology: carbon black filled rubbers incorporating Mullins' effect
Announcements	235	

Number 2

J. R. Rice	239	Dislocation nucleation from a crack tip: an analysis based on the Peierls concept
D. Harris	273	Plasticity models for soil, granular and jointed rock materials

R. Mohan, M. Ortiz and C. F. Shih — 291 — An analysis of cracks in ductile single crystals—I. Anti-plane shear

R. Mohan, M. Ortiz and C. F. Shih — 315 — An analysis of cracks in ductile single crystals—II. Mode I loading

S. Krishnaswamy, H. V. Tippur and A. J. Rosakis — 339 — Measurement of transient crack-tip deformation fields using the method of coherent gradient sensing

I. Jasiuk, J. Chen and M. F. Thorpe — 373 — Elastic moduli of composites with rigid sliding inclusions

H. Gao, M. Abbudi and D. M. Barnett — 393 — Interfacial crack-tip field in anisotropic elastic solids

B. Loret and Y. F. Dafalias — 417 — The effect of anisotropy and plastic spin on fold formations

J. R. Willis — 441 — On methods for bounding the overall properties of nonlinear composites: correction and addition

V. Tvergaard and A. Needleman — 447 — Effect of crack meandering on dynamic, ductile fracture

K. Schulgasser — 473 — Relationships between the effective properties of transversely isotropic piezoelectric composites

Announcements — 481

Number 3

A. G. Varias, Z. Suo and C. F. Shih — 485 — Mode mixity effect on the damage of a constrained ductile layer

E. Zywicz and D. M. Parks — 511 — Small-scale yielding interfacial crack-tip fields

S. R. Kalidindi, C. A. Bronkhorst and L. Anand — 537 — Crystallographic texture evolution in bulk deformation processing of fcc metals

H. Hou and R. Abeyaratne — 571 — Cavitation in elastic and elastic plastic solids

S. Jansson and F. A. Leckie — 593 — Mechanical behavior of a continuous fiber-reinforced aluminum matrix composite subjected to transverse and thermal loading

Z. Suo, M. Ortiz and A. Needleman — 613 — Stability of solids with interfaces

J. J. Mason, J. Lambros and A. J. Rosakis — 641 — The use of a coherent gradient sensor in dynamic mixed-mode fracture mechanics experiments

P. Ståhle — 663 — A mode III crack subjected to high strain rates

L. An and D. G. Schaeffer — 683 — The flutter instability in granular flow

L. B. Freund and A. J. Rosakis — 699 — The structure of the near-tip field during transient elastodynamic crack growth

Announcement — 721

Number 4

B. L. Adams, J. P. Boehler, M. Guidi and E. T. Onat — 723 — Group theory and representation of microstructure and mechanical behavior of polycrystals

Z. Suo, C.-M. Kuo, D. M. Barnett and J. R. Willis — 739 — Fracture mechanics for piezoelectric ceramics

Z. Hashin — 767 — Extremum principles for elastic heterogenous media with imperfect interfaces and their application to bounding of effective moduli

J. C. Michel and P. Suquet — 783 — The constitutive law of nonlinear viscous and porous materials

Q. Qin and J. L. Bassani — 813 — Non-Schmid yield behavior in single crystals

Q. Qin and J. L. Bassani — 835 — Non-associated plastic flow in single crystals

S. Nirmalendran and H. Horii — 863 — Analytical modeling of microcracking and bridging in the fracture of quasi-brittle materials

R. V. Craster and C. Atkinson — 887 — Shear cracks in thermoelastic and poroelastic media

Announcement — 925

Number 5

M. MILGROM and S. SHTRIKMAN 927 The energy of inclusions in linear media exact shape-independent relations

N. P. O'DOWD and C. F. SHIH 939 Family of crack-tip fields characterized by a triaxiality parameter—II. Fracture applications

D. KRAJCINOVIC, M. BASISTA, K. MALLICK and D. SUMARAC 965 Chemo-micromechanics of brittle solids

C. L. HOM 991 Three-dimensional finite element analysis of plastic deformation in a whisker-reinforced metal matrix composite

M. M. RASHID 1009 Texture evolution and plastic response of two-dimensional polycrystals

A. R. DAY, K. A. SNYDER, E. J. GARBOCZI and M. F. THORPE 1031 The elastic moduli of a sheet containing circular holes

K. BOSE and P. PONTE CASTAÑEDA 1053 Stable crack growth under mixed-mode conditions

G. W. MILTON 1105 Composite materials with Poisson's ratios close to −1

N. A. FLECK, L. T. KUHN and R. M. MCMEEKING 1139 Yielding of metal powder bonded by isolated contacts

Number 6

iii Editorial statement

P. ROSAKIS 1163 Compact zones of shear transformation in an anisotropic solid

D. E. GRADY 1197 Properties of an adiabatic shear-band process zone

T. W. WRIGHT and H. OCKENDON 1217 A model for fully formed shear bands

H. PETRYK 1227 Material instability and strain-rate discontinuities in incrementally nonlinear continua

W. TONG, R. J. CLIFTON and S. HUANG 1251 Pressure–shear impact investigation of strain rate history effects in oxygen-free high-conductivity copper

Y. BENVENISTE and G. J. DVORAK 1295 Uniform fields and universal relations in piezoelectric composites

D. BIGONI and D. ZACCARIA 1313 Loss of strong ellipticity in non-associative elastoplasticity

C. K. Y. LEUNG and V. C. LI 1333 Effect of fiber inclination on crack bridging stress in brittle fiber reinforced brittle matrix composites

B. LORET 1363 Does deviation from deviatoric associativity lead to the onset of flutter instability?

V. TVERGAARD and J. W. HUTCHINSON 1377 The relation between crack growth resistance and fracture process parameters in elastic–plastic solids

Erratum 1399

Number 7

ELASTIC WAVES AND RELATED TOPICS

J. WILLIS 1401 Dedication

1403 Peter Chadwick, FRS

1407 Peter Chadwick's publications

1411 Elastic waves and related topics

C. ATKINSON and R. V. CRASTER 1415 Fracture in fully coupled dynamic thermoelasticity

D. M. BARNETT and J. LOTHE 1433 Conditions admitting the existence of type 3 transonic states in stable anisotropic linear elastic media

PH. BOULANGER and M. HAYES	1449	Shear, shear stress and shearing
S. C. COWIN and M. M. MEHRABADI	1459	The structure of the linear anisotropic elastic symmetries
J. DUNWOODY	1473	Linear thermoelastic singular surfaces: a revision
S. P. A. GILL and F. M. LESLIE	1485	Reflection and refraction of an obliquely incident shear wave at a solid–smectic liquid crystal interface
E. R. GREEN and W. A. GREEN	1495	Reciprocal relations for dynamic Green's functions in fibre composite laminates
V. G. HART and J. SHI	1507	Joined dissimilar elastic thin tubes containing steady viscous flow
A. P. HARVEY, R. E. CRAINE and S. SYNGELLAKIS	1529	Propagation of nonlinear surface acoustic waves on elastic and piezoelectric solids
G. A. MAUGIN	1543	Applications of an energy-momentum tensor in nonlinear elastodynamics: pseudomomentum and Eshelby stress in solitonic elastic systems
A. I. MURDOCH	1559	Remarks on the foundations of linear viscoelasticity
A. N. NORRIS	1569	One-component surface waves in materials with symmetry
D. F. PARKER	1583	Elastic wedge waves
T. G. ROGERS, I. D. R. BRADFORD and A. H. ENGLAND	1595	Finite plane deformations of highly anisotropic elastic–plastic plates and shells
N. H. SCOTT	1607	Plane waves in twinned crystals modelled as multi-constrained and nearly constrained elastic materials
A. J. M. SPENCER and P. WATSON	1621	Buckling of laminated anisotropic plates under cylindrical bending
T. C. T. TING	1637	The motion of one-component surface waves
G. E. TUPHOLME and A. P. HARVEY	1651	Intermodulation distortion of nonlinear piezoelectric surface waves
L. J. WALPOLE	1663	Long elastic waves in a periodic composite

J. R. WILLIS 1671 The stress field near the tip of an accelerating crack

Number 8

P. S. SYMONDS I Obituary: Professor Herbert Kolsky

I. D. ABRAHAMS and G. R. WICKHAM 1683 Scattering of elastic waves by an arbitrary small imperfection in the surface of a half-space

I. D. ABRAHAMS and G. R. WICKHAM 1707 Scattering of elastic waves by a small inclined surface-breaking crack

C. FRESSENGEAS and A. MOLINARI 1735 The time development of Eulerian/Lagrangian perturbations to simple shear and its applications to shear banding

P. PONTE CASTAÑEDA 1757 New variational principles in plasticity and their application to composite materials

M. GOSZ, B. MORAN and J. D. ACHENBACH 1789 Load-dependent constitutive response of fiber composites with compliant interphases

B. J. LEE and M. E. MEAR 1805 Axisymmetric deformation of power-law solids containing a dilute concentration of aligned spheroidal voids

Y. L. CUI 1837 Interaction of fiber and transformation toughening

Announcements 1851

Index to Volume 40 i

AUTHOR INDEX

Abbudi, M. 393
Abeyaratne, R. 571
Abrahams, I. D. 1683, 1707
Achenbach, J. D. 1789
Adams, B. L. 723
An, L. 683
Anand, L. 537
Argon, A. S. 141
Atkinson, C. 887, 1415

Bao, G. 1
Barber, J. R. 17
Barnett, D. M. 393, 739, 1433
Basista, M. 965
Bassani, J. L. 813, 835
Benveniste, Y. 1295
Bigoni, D. 1313
Boehler, J. P. 723
Bose, K. 1053
Boulanger, Ph. 1449
Bradford, I. D. R. 1595
Bronkhorst, C. A. 537

Chen, J. 373
Choi, H. C. 75
Christensen, R. 69
Clifton, R. J. 1251
Cornie, J. A. 141
Cowin, S. C. 1459
Craine, R. E. 1529
Craster, R. V. 887, 1415
Cui, Y. L. 1837

Dafalias, Y. F. 417
Day, A. R. 1031
Dunwoody, J. 1473
Dvorak, G. J. 1295

England, A. H. 1595

Fan, B. 1
Fleck, N. A. 1139
Fressengeas, C. 1735
Freund, L. B. 699

Gao, H. 393
Garboczi, E. J. 1031
Gill, S. P. A. 1485
Gosz, M. 1789
Govindjee, S. 213
Grady, D. E. 1197
Green, E. R. 1495
Green, W. A. 1495
Guidi, M. 723
Gupta, V. 141

Harris, D. 273
Hart, V. G. 1507
Harvey, A. P. 1529, 1651
Hashin, Z. 767
Hayes, M. 1449
Hom, C. L. 991
Horii, H. 863
Hou, H. 571
Huang, S. 1251
Hutchinson, J. W. 1377

Jansson, S. 593
Jasiuk, I. 373

Kalidindi, S. R. 537
Kim, K.-H. 127
Kim, K.-S. 75
Krajcinovic, D. 965
Krishnaswamy, S. 339
Kuhn, L. T. 1139
Kuo, C.-M. 739

Lambros, J. 641
Leckie, F. A. 593
Lee, B. J. 1805
Leroy, Y. M. 181
Leslie, F. M. 1485
Leung, C. K. Y. 1333
Li, V. C. 1333
Loret, B. 417, 1363
Lothe, J. 1433

Mallick, K. 965
Mason, J. J. 641
Maugin, G. A. 1543
McCartney, L. N. 27
McMeeking, R. M. 1139
Mear, M. E. 1805
Mehrabadi, M. M. 1459
Michel, J. C. 783
Milgrom, M. 927
Milton, G. W. 1105
Mohan, R. 291, 315
Molinari, A. 181, 1735
Moran, B. 1789
Murdoch, A. I. 1559

Needleman, A. 447, 613
Nirmalendran, S. 863
Norris, A. N. 1569

O'Dowd, N. P. 939
Ockendon, H. 1217
Onat, E. T. 723
Ortiz, M. 291, 315, 613

Parker, D. F. 1583
Parks, D. M. 141, 511
Petryk, H. 1227
Ponte Castañeda, P. 1053, 1757

Qin, Q. 813, 835

Rashid, M. M. 1009
Rice, J. R. 239
Rogers, T. G. 1595
Rosakis, A. J. 339, 641, 699
Rosakis, P. 1163
Rubinstein, A. A. 105

Schaeffer, D. G. 683
Schantz, H. 69
Schulgasser, K. 473
Scott, N. H. 1607
Shapiro, J. 69
Shi, J. 1507
Shih, C. F. 291, 315, 485, 939
Shtrikman, S. 927
Simo, J. 213
Snyder, K. A. 1031
Spencer, A. J. M. 1621
Ståhle, P. 663
Sturla, F. A. 17
Sumarac, D. 965
Suo, Z. 1, 485, 613, 739
Suquet, P. 783
Syngellakis, S. 1529

Thorpe, M. F. 373, 1031
Ting, T. C. T. 1637
Tippur, H. V. 339
Tong, W. 1251
Tupholme, G. E. 1651
Tvergaard, V. 447, 1377

Varias, A. G. 485

Walpole, L. J. 1663
Watson, P. 1621
Wickham, G. R. 1683, 1707
Willis, J. R. 441, 739, 1401, 1671
Wright, T. W. 1217

Xu, K. 105

Zaccaria, D. 1313
Zywicz, E. 511

Printed in Great Britain by BPCC-AUP Aberdeen Ltd.

Reproduced with the permission of Pergamon Press Inc., by University Microfilms Inc. Duplication or resale without permission is prohibited.